in length. Two persons were killed and several wounded; many dwellings and out-buildings were destroyed, entailing a loss of $100,000. A tornado also occurred on this date in Randolph county, between Wedowee and Roanoke, killing two persons and destroying many buildings.

Waverly, Clay county, Mississippi: at 5 p. m. on the 11th a tornado occurred five miles north of this place. The cloud is reported to have been balloon-shaped, its path being from six to seven miles in length; some houses were blown down.

Haddock's station, Jones county, Georgia: a tornado occurred three miles north of this place at noon on the 12th; it moved east 25° north for a distance of twelve miles, passing two miles south of Brown's Crossing, Baldwin county, and ending one mile north of Milledgeville, in the same county; its path was from six to nine hundred feet in width. No loss of life occurred, but four persons were wounded; three dwellings and many out-buildings were destroyed.

Herndon, Buck county, Georgia: at 3 a. m. on the 12th, a tornado occurred in the southern part of this county, and moved eastward, the width of the tornado's path being 3000 feet. Four persons were injured, and twenty dwellings and numerous out buildings were destroyed.

East Liverpool, Columbiana county, Ohio: a violent storm occurred at this place about midnight of the 16–17th, causing great damage. The storm was preceded by a heavy roaring sound resembling that caused by a moving train. Numerous buildings at this place were unroofed or otherwise damaged; considerable damage is also reported from the surrounding country.

Albany, Dougherty county, Georgia: during the night of the 16th–17th, a tornado passed through this county, nine miles east of Albany. Timber, fences and buildings were blown down.

Steubenville, Jefferson county, Ohio: a severe storm prevailed here during the night of the 16–17th. Several buildings were damaged and trees blown down.

Pike's Peak, Colorado: very high wind prevailed on the 16th; the maximum velocity was eighty-eight miles from the northwest; a part of the stable roof was torn off, and carried a distance of one hundred yards; broken planks, etc., were carried down the mountain side for a distance of one-half mile.

The observer on the summit of Mount Washington, New Hampshire, reports the following: the barometer fell rapidly on the 21st, and during the evening, the wind increased to hurricane force, attaining a velocity of ninety-five miles. The hurricane continued during the following day without abatement, a velocity of one hundred and ten miles occurring. On this date the total wind movement was 2,140 miles, which is the largest daily movement ever recorded at this station. From 11 p. m. on the 21st, to 3 p. m. on the 22d, the average hourly velocity was ninety-five miles, and this figure is less than the actual velocity, as frost-work on the anemometer caused it to record a velocity less than the actual movement.

NAVIGATION.

STAGE OF WATER IN RIVERS.

The Missouri river was frozen during the entire month at Leavenworth, Kansas, and to the northward.

The Mississippi river was frozen at Keokuk, Iowa, and to the northward. At Keokuk, the ice moved slightly on the afternoon of the 8th, and during the succeeding twenty-four hours the river rose from 11.6 feet to 14.2 or 0.2 above the danger-line. Observations of the river's height were made at Keokuk from the 8th to 13th; although the river was frozen during that time there was a range of 2.6 feet. At Vicksburg, Mississippi, the highest stage occurred on the 31st, when the water was 1.3 feet above the danger-line.

In the Ohio river, at Pittsburg, the water rose to one foot above the danger line on the 17th, and at Cincinnati, Ohio, it was within four and two-tenths feet of the danger-line, when at its highest stage on the 19th.

The largest ranges of water occurred in the Ohio river at Cincinnati, and in the Cumberland river at Nashville, being 32.5 feet in the former and 33.8 in the latter.

In the following table are shown the danger points in the rivers at the various stations, the highest and lowest depths for January, 1885, with the dates of occurrence, and the monthly ranges:

Heights of rivers above low-water mark, January, 1885.

[*Expressed in feet and tenths*]

Stations.	Danger-point on gauge.	Highest water.		Lowest water.		Monthly range.
		Date.	Height.	Date.	Height.	
Red River:						
Shreveport, Louisiana	29 9	16	28 6	1	20 6	8 0
Arkansas:						
Fort Smith, Arkansas	15 0	1	11 5	23, 24	‡— 0 8	12 3
Little Rock, Arkansas	23 0	1	23 3	27, 28	8 0	15 3
Missouri:						
Yankton, Dakota*	24 0	.....	.....	.....	.....	.....
Omaha, Nebraska*	18 0	.....	.....	.....	.....	.....
Leavenworth, Kansas*	20 0	.....	.....	.....	.....	.....
Mississippi:						
Saint Paul, Minnesota*	14 6	.....	.....	.....	.....	.....
La Crosse, Wisconsin*	24 0	.....	.....	.....	.....	.....
Dubuque, Iowa*	16 0	.....	.....	.....	.....	.....
Davenport, Iowa*	15 0	.....	.....	.....	.....	.....
Keokuk, Iowa †	14 0	9	14 2	8	11 6	2 6
Saint Louis, Missouri	32 0	2	17 5	29	8 8	8 7
Cairo, Illinois	40 0	25, 26	39 0	1	27 0	12 0
Memphis, Tennessee	34 0	28	30 2	1	15 8	14 4
Vicksburg, Mississippi	41 0	31	42 3	1	17 2	25 1
New Orleans, Louisiana†	—3 0	23, 31	— 1 7	1	—10 6	8 9
Ohio:						
Pittsburg, Pennsylvania	22 0	17	23 0	31	2 9	20 1
Cincinnati, Ohio	50 0	19	45 8	29	13 3	32 5
Louisville, Kentucky	25 0	20, 21	21 9	4, 5	6 7	15 2
Cumberland:						
Nashville, Tennessee	40 0	21	37 8	5	4 0	33 8
Tennessee:						
Knoxville, Tennessee	.....	.....	.....	.....	.....	.....
Chattanooga, Tennessee	33 0	18	26 5	1, 5	3 6	22 9
Monongahela:						
Pittsburg, Pennsylvania	29 0	17	23 0	31	2 9	20 1
Savannah:						
Augusta, Georgia	32 0	26	27 5	4	7 0	20 5
Mobile:						
Mobile, Alabama	.....	31	17 6	1	12 0	5 6
Sacramento:						
Red Bluff, California	.....	.....	.....	.....	.....	.....
Sacramento, California	.....	1	23 5	31	17 0	6 5
Willamette:						
Portland, Oregon	.....	9	15 9	27	1 9	14 0
Colorado:						
Yuma, Arizona	.....	.....	.....	.....	.....	.....

‡ Below bench mark. † Below high-water mark of 1874 and 1883.
* Frozen the entire month. ‡ Observations from 8th to 13th, although frozen.

ICE IN RIVERS AND HARBORS.

Arkansas river.—Fort Smith, Arkansas: floating ice on 17th, 18th, 19th, 22d; river free from ice on 25th.

Sherlock, Finney county, Kansas: ice was of a thickness sufficient to bear the weight of teams during the latter half of the month.

Casco bay.—Portland, Maine: on the 23d the harbor was filled with floating ice; on the 22d the steamer "Popham," was cut through by the ice and sank on Phipsburg flats.

Chincoteague bay.—Chincoteague, Virginia: the bay froze over on the 23d.

Connecticut river.—Hartford, Connecticut: the river froze over on the 21st and 22d for the third time this winter; on the latter date the river was frozen for a distance of five hundred miles, and within five miles of Long Island sound.

Delaware bay.—Delaware Breakwater, Delaware: on the 23d the harbor was filled with ice which went out at ebb tide.

Detroit river.—Detroit, Michigan: floating ice 2d, 3d, 10th, 11th, 13th, 15th, 19th, 20th, 22d, 24th, 25th.

Grand river.—Grand Haven, Michigan: on the 1st, the river was frozen along the shores and the channel was filled with slush ice; the river was nearly free from ice on the 3d; on the 13th it was partially frozen.

Lansing, Michigan: the river closed on the 15th for the third time this winter.

Grand Traverse bay.—Traverse City, Michigan; the bay froze on the 26th.

Hudson river.—Albany, New York: on the 1st, the ice began to move and formed a dam at Van Wie's point, causing the

water to submerge the docks and Quay street, but little damage resulted; floating ice on 2d; river frozen on 3d.

Lake Huron.—Port Huron, Michigan; on the 19th, the lake was covered with ice as far as the eye could reach.

Lake Michigan—Traverse City, Michigan: the lake was frozen over as far as the eye could reach on the 28th.

Manistique, Schoolcraft county, Michigan: on the 27th, the ice in the lake extended beyond the range of vision.

Grand Haven, Michigan: the harbor entrance was closed by ice on the 14th, detaining the propellers "Oneida" and "Michigan;" it was also closed on the 20th; on the 21st, the ice was firmly grounded on the bar, and extended lakeward as far as the eye could reach; on the 23d, a large quantity of ice drifted lakeward, but on the 24th, it was again driven into the harbor by the westerly wind; on the 30th and 31st, the harbor was blocked with ice.

Milwaukee, Wisconsin: at the close of January, the ice in the lake was unusually heavy. Navigation between this place and the ports on the opposite side of the lake was suspended during the latter half of the month. The propeller "Oneida" was caught in the ice-fields off Grand Haven on the 20th, and from that date until the close of the month, drifted with the ice, being unable to reach either shore.

Lake Superior.—Duluth, Minnesota: the lake was covered with ice on the 1st; on the 8th, it was clear of ice; on the 13th and 14th, the lake was frozen for a distance of one-half mile from the shore; on the 16th, the ice extended as far as could be seen.

Mississippi river.—Memphis, Tennessee: floating ice on the 6th, 7th, 18th, 23d, 24th.

Cairo, Illinois: navigation was suspended on account of ice on the 2d and 16th. At Keokuk, Iowa, and at all stations to the northward the river was frozen throughout the month; at Keokuk the ice moved slightly between 5 and 6 p. m. on the 8th.

Missouri river.—Leavenworth, Kansas: the river was frozen throughout the month at this place and at all points northward.

Narragansett bay.—Narragansett Pier, Rhode Island: on the 31st large fields of ice passed out of the western entrance of the bay.

New Haven harbor.—New Haven, Connecticut: the harbor froze over on the 23d; on the 29th the ice, moving with the tide, forced two vessels on the beach; on the 30th the harbor was filled with heavy floating ice which caused damage to the West Haven jetty.

New York harbor.—New York city: floating ice, 27th and 29th.

Niagara river.—Buffalo, New York: river frozen throughout the month.

North branch, Susquehanna river.—Catawissa, Pennsylvania: the river closed on the 28th and 29th.

Ohio river.—Pittsburg, Pennsylvania: floating ice from 1st to 9th, 14th, 15th, 16th, 18th to 30th.

Portsmouth, Scioto county, Ohio: the river was full of floating ice from 1st to 6th and 23d to 31st.

Cincinnati, Ohio: floating ice from 26th to 31st; navigation was interrupted on 27th.

Louisville, Kentucky, drift-ice on 1st, 2d, 3d, 5th, 19th, 28th, 29th, 30th; the canal froze over on the 18th.

Oswego river.—Oswego, New York: on the 22d the river was frozen from the lower bridge to the pier; the ice broke up on the 23d; on the 28th the river was again frozen as on the 22d.

Patapsco river.—Baltimore, Maryland: on the 22d, drift-ice obstructed navigation; on the 24th, there was considerable ice in the river and in Chesapeake bay; several vessels were reported fast in the ice twenty miles below the city; the ice was two inches thick from Baltimore to Seven-foot Knoll on the 29th; on the 30th there was heavy ice in the bay and river, and numerous boats were frozen in the ice.

Potomac river.—Washington, District of Columbia: the ice broke up on the 6th, and on the 7th the river was clear of ice; floating ice on 21st; river frozen on 22d, 30th, 31st.

Alexandria, Virginia: navigation was practically closed by ice on the 29th; the steamer "John Gibson" arrived from Washington on this date, having been fourteen hours in making the trip.

Saint Clair river.—Port Huron, Michigan: river blocked with ice on 1st; on 29th the river was frozen.

Sandusky river.—Tiffin, Seneca county, Ohio: the ice broke up during the latter part of December; the river closed again on January 17th; on the 22d the ice was seven inches thick.

Susquehanna river.—Columbia, Lancaster county, Pennsylvania: the river froze over on the 23d for the second time this winter.

Port Deposit, Maryland: on the 23d an ice-dam extended from Garret's island, three miles south of this place for a distance of several miles northward. On the afternoon of the 23d the ice accumulated to a depth of fifteen feet on the opposite side of the river, causing the water to overflow the entire southern portion of the town.

Wilkesbarre, Pennsylvania: during the night of the 1–2d an ice-dam formed near Nanticoke, causing an overflow of the lowlands near the west side of the river. Railroad and other communication between this place and Kingston was entirely cut off. At Havre de Grace, Maryland, on this date, an ice-dam and freshet were apprehended, but the ice passed out without causing damage.

Miscellaneous.—Bangor, Maine: the ice in Kenduskeag creek broke up on the 12th.

New Haven, Connecticut, 28th: the first ice harvested this season on Lake Whitney; ice ten inches thick.

Toledo, Ohio: the ice in Maumee river was eight inches thick on the 21st.

FLOODS.

Jasper, Dubois, county, Indiana: on the 1st the Patoka river reached a high stage, flooding several mills and lumber yards.

Grand Rapids, Michigan: the river reached an unusual height during the night of the 4–5th. An ice-dam formed at Lamont, sixteen miles below here, which caused the river to overflow as far as Ionia, thirty miles north of Grand Rapids. On the 11th the damage caused at Grand Rapids by the overflow was estimated at from $50,000 to $150,000.

Vincennes, Indiana: the Wabash river reached a high stage on the 5th. Residents on the low-lands near the river were compelled to move to places of safety. An overflow occurred in White river, flooding the adjacent country for miles; many families in Daviess and Pike counties were compelled to abandon their homes and thousands of saw-logs were swept away.

Shreveport, Louisiana: on the 16th the Red river rose to a height of 28.6 feet, flooding the adjacent low-lands. Planters along the river moved their stock to places of safety. Trains were delayed on account of washouts on the railroads.

Pittsburg, Pennsylvania: the Alleghany river reached a height of twenty-four feet at 10.30 p. m. on the 17th; the track of the Pittsburg and Western railroad was overflowed, causing suspension of travel.

Chattanooga, Tennessee: the heavy rains of the 15th and 16th caused the small streams to overflow the low-lands. Railroad communication was interrupted on all railroads centering here, with the exception of East Tennessee, Virginia and Georgia. A small stream near Woodville, Jackson county, Alabama, overflowed, washing away an embankment on the Memphis and Charleston railroad; for a distance of one mile the track was covered with water to a depth of three feet. A serious washout occurred on the Nashville, Chattanooga and Saint Louis railroad. Washouts also occurred on the Cincinnati Southern railroad.

Huntingdon, Huntingdon county, Pennsylvania: the heavy rains on the 15th and 16th, caused the streams in this section to rise to unusual heights, rendering travel impracticable on account of washouts in the roadways.

Corpus Christi, Nueces county, Texas, 23d: the continuous rains for several days past have flooded this section. Large numbers of sheep have died from the effects of the wet weather.

Houston, Texas, 23d: the continuous rains throughout southern and eastern Texas, during the past few days have caused much damage to live stock and railroads. All streams were much swollen. Travel on the Texas and New Orleans railroad was suspended on account of extensive washouts. Heavy losses in sheep and cattle have been reported in consequence of the severe weather.

Vicksburg, Mississippi, 31st: Captain Sears, U. S. Engineer Corps, arrived on this date from a tour of inspection of the levees south of Memphis, and reported breaks in the Opossum Fork levee, one hundred and fifty miles north of Vicksburg, and in the Long Lake levee, seventeen miles below Helena.

A break three hundred and fifty feet wide also occurred in Disonia levee, in East Carroll parish, Louisiana, which caused the inundation of the Queen and Crescent railway.

HIGH TIDES.

New Haven, Connecticut, 5th.
Eastport, Maine, 15th.
Fort Macon, North Carolina, 2d.
New River Inlet, North Carolina, 2d, 3d, 15th, 16th, 17th.

LOW TIDES.

Delaware Breakwater, Delaware, 30th.
New York City, New York, 18th.
Indianola, Texas, 17th, 18th.

TEMPERATURE OF WATER.

The following table shows the highest and lowest temperatures of water at the several stations; the monthly ranges of water temperature; the average depth at which the observations were made; and the mean temperature of the air:

Temperature of water for January, 1885.

Station.	Temperature at bottom.		Range.	Average depth, feet and tenths.		Mean temperature of the air at station.
	Max.	Min.				
	°	°	°			°
Atlantic City, New Jersey	35.1	32.3	2.8	3	0	32.3
Alpena, Michigan†						
Augusta, Georgia	50.8	38.0	12.8	13	8	45.4
Baltimore, Maryland	36.8	32.5	4.3	9	7	34.0
Block Island, Rhode Island*	43.8	33.5	10.3	7	7	31.5
Boston, Massachusetts	36.6	28.9	7.7	21	1	27.0
Buffalo, New York†						
Canby, Fort, Washington Territory	47.0	37.9	9.1	17	5	41.7
Cedar Keys, Florida	65.7	50.7	15.0	9	3	56.5
Charleston, South Carolina	54.1	39.3	14.8	41	0	50.7
Chicago, Illinois‡	32.9	31.8	1.1	7	7	18.3
Chincoteague, Virginia	47.5	21.5	26.0	4	1	36.6
Cleveland, Ohio†						
Detroit, Michigan†						
Delaware Breakwater, Delaware	52.1	29.5	22.6	8	5	35.3
Duluth, Minnesota†						
Eastport, Maine	38.4	35.3	3.1	14	8	20.3
Escanaba, Michigan†						
Galveston, Texas	60.6	39.2	21.4	12	2	50.6
Grand Haven, Michigan §	33.6	32.1	1.5	19	0	20.7
Indianola, Texas	58.6	36.8	21.8	8	0	47.4
Jacksonville, Florida	61.4	54.4	7.0	18	0	56.2
Key West, Florida	77.6	67.5	10.1	10	7	71.9
Mackinaw City, Michigan†						
Macon, Fort, North Carolina	56.0	42.3	13.7	7	0	46 0
Marquette, Michigan						
Milwaukee, Wisconsin†						
Mobile, Alabama	68.4	45.2	23.2	15	7	48.2
New Haven, Connecticut	39.0	29.9	9.1	16	0	26.8
New London, Connecticut	40.8	36.1	4.7	11	2	29.0
New York City	39.5	31.0	8.5	15	7	29.2
Norfolk, Virginia	46.2	38.4	7.8	10	7	42.7
Pensacola, Florida	61.3	47.9	13.4	17	2	50.7
Portland, Maine	36.2	30.1	6.1	10	0	24.3
Portland, Oregon	41.0	33.4	7.6	55	8	36.3
Sandusky, Ohio†						
Sandy Hook, New Jersey	43.8	33.8	10.0	1	8	31.0
San Francisco, California	53.4	49.0	4.4	35	5	50.6
Savannah, Georgia	55.3	46.0	9.3	9	7	51.5
Smithville, North Carolina	52.0	47.8	4.2	10	5	46.6
Toledo, Ohio†						
Wilmington, North Carolina	52.4	45.1	7.3	16	8	49.2

† Frozen throughout the month. * Record from 6th to 18th—thermometer broken. ‡ Frozen from 1st to 7th and from 13th to 30th. § Frozen on 1st and 2d and from 13th to 31st.

VERIFICATIONS.

INDICATIONS.

The detailed comparison of the tri-daily indications for January, 1885, with the telegraphic reports for the succeeding twenty-four hours, shows the general average percentage of verifications to be 85.99 per cent. The percentages for the four elements are: Weather, 88.34; direction of the wind, 82.86; temperature, 82.91; barometer, 92.26 per cent. By geographical districts, they are: For New England, 87.25; middle Atlantic states, 89.43; south Atlantic states, 86.08; eastern Gulf states, 89.04; western Gulf states, 85.69; lower lake region, 87.86; upper lake region, 85.53; Ohio valley and Tennessee, 85.76; upper Mississippi valley, 84.53; Missouri valley, 80.25; north Pacific coast region, 77.68; middle Pacific coast region, 70.54; south Pacific coast region, 84.82. There were seventeen omissions to predict out of 3,419, or 0.50 per cent. Of the 3,402 predictions that have been made, seventy-seven, or 2.26 per cent., are considered to have entirely failed; one hundred and twenty-eight, or 3.76 per cent., were one-fourth verified; three hundred and fifty-four, or 10.41 per cent., were one-half verified; five hundred and seven, or 14.90 per cent., were three-fourths verified; 2,336, or 68.67 per cent., were fully verified, so far as can be ascertained from the tri-daily reports.

CAUTIONARY SIGNALS.

During January, 1885, two hundred and six cautionary signals were ordered. Of these, one hundred and eighty-five, or 89.81 per cent., were justified by winds of twenty-five miles or more per hour at or within one hundred miles of the station. One hundred and eighty-seven off-shore signals were ordered, of which number one hundred and sixty-nine, or 90.37 per cent. were fully justified, both as to direction and velocity; one hundred and eighty-one, or 96.79 per cent., were justified as to direction; and one hundred and seventy-one, or 91.44 per cent., were justified as to velocity. Three hundred and ninety-three signals of all kinds were ordered, three hundred and fifty-four, or 90.08 per cent., being fully justified. These do not include signals ordered at display stations where the velocity of the wind is only estimated. Of the above cautionary off-shore signals one hundred and nineteen were changed from cautionary. In thirty-six cases winds of twenty-five miles or more per hour were reported for which no signals were ordered.

COLD-WAVE SIGNALS.

During January, 1885, there were two hundred and forty-six cold-wave signals ordered of which number, two hundred and twenty-six, or 91.9 per cent. were justified.

RAILWAY WEATHER SIGNALS.

The following is from the report of the "Ohio Meteorological Bureau," under direction of Prof. T. C. Mendenhall:

The verification of railway signals for the month was as follows: For temperature, 95 per cent.; for state of weather, 89 per cent. The cold-wave signal has been displayed several times during the month, and verified in every case.

The following is from the report of the "Tennessee Weather Service," under direction of Hon. A. J. McWhirter:

The great benefits of the weather service to the people throughout the state, and especially to those engaged in agricultural pursuits, will be more fully realized and appreciated when the system of railway signals shall have been adopted, and it is to be hoped that our legislators will give sufficient aid to the bureau to enable the director to put this excellent system into practical operation at an early day.

The following is from the report of the "Alabama Weather Service," under direction of Prof. P. H. Mell, jr.:

The predictions for the month of January telegraphed by General Hazen, the Chief Signal Officer, were as follows:
Local rains.—1, 4, 5, 11, 14, 20, 23, 31.
General rains.—15, 16, 24, 25, 28.
Fair weather.—2, 3, 6 to 10, 12 to 19, 21, 22, 26, 27, 29, 30.
Lower temperature.—1, 6, 7, 10, 12, 13, 16, 17, 22, 28.
Higher temperature.—2 to 5. 8. 9, 11, 15, 18, 19, 23, 24, 26, 27, 29 to 31.
Stationary temperature.—14, 20, 21.
Cold wave.—1, 10, 12, 15, 22, 27.
The verification of signals for January was 87 per cent. for weather, and 91 per cent. for temperature.